Pilot Study on Activities of Daily Living Limitations in Adults With Hemianopsia

Mary Warren

KEY WORDS
• activities of daily living
• brain injuries
• hemianopsia
• vision disorders
• visual fields

OBJECTIVE. I sought to obtain a general understanding of the limitations in activities of daily living (ADLs) experienced by adults with hemianopsia and quadrantanopsia from acquired brain injury.

METHOD. A semistructured interview addressing the perception of difficulty completing ADLs because of vision loss and a reading performance test were administered to 46 participants referred to a low vision rehabilitation program.

RESULTS. Participants reported difficulty completing two basic ADLs, personal hygiene–grooming and feeding, and several instrumental ADLs, including driving, shopping, financial management, telephone usage, and meal preparation. ADL limitations appear to be related to the amount of visual search needed to complete the ADL and disruption of the performance skills of reading, writing, and mobility.

CONCLUSION. People with hemianopsia experience limitations in specific ADLs as a direct result of the disruption of the visual field. Further investigation is needed to confirm these findings and explore interventions to improve ADL performance.


Visual field deficit (VFD) is reported to be the most frequently occurring visual impairment after posterior brain injury, with approximately 75% of VFD consisting of homonymous hemianopsia, which is a loss of half of the visual field in each eye (Kerkhoff, 2000). Stroke is the most common cause of hemianopsia; other causes include traumatic brain injury (TBI) and tumor (Bruce, Zhang, Kedar, Newman, & Biousse, 2006; Gilhotra, Mitchell, Healey, Cumming, & Currie, 2002). Disruption of the ability to search the blind portion of the visual field is one of the most frequently reported changes in visual performance after onset of VFD (Kerkhoff, 2000; Zihl, 2000). Research has shown that visual search toward the blind field becomes disorganized, resulting in longer search times and inconsistent exploration of space (Tant, Cornelissen, Kooijman, & Brouwer, 2002; Zihl, 2000). Saccades toward the blind field increase in number but have shorter fixation times and amplitudes (Pambakian et al., 2000). These search changes impair the person’s ability to retrieve information from the environment, reducing the ability to comprehend what is occurring in a visual scene and to respond in an appropriate and timely fashion (Kerkhoff, 2000; Zihl, 2000).

The Ecology of Human Performance (EHP) framework postulates that occupational performance is a product of the interaction among the person, the context, and the task (Dunn, Brown, & McGuigan, 1994). A negative change in any of the three components disrupts the balance between them with the effect of reducing the person’s performance range, which consists of the tasks (including activities of daily living [ADLs]) he or she can successfully complete. The disruption of visual
search that accompanies VFD can cause incomplete and erroneous perception of the physical environmental context. Without the benefit of an accurately constructed physical context, according to the EHP framework, people with VFD would likely experience limitations in the range of ADLs they could successfully complete. In addition, the observed ADL limitations would be related to the amount of visual search needed for the task, so that an ADL that requires a wide visual search or search of a complex visual array would be more likely to be impaired than an ADL made up of tasks with simple features and a limited search field. Thus, people with VFD should experience specific limitations in ADL performance that are directly related to the effect of the vision loss and the search requirements of the task.

Few investigations have focused on the limitations in ADLs experienced by adults with VFD after acquired brain injury (ABI). The studies that have addressed occupational limitations have concentrated primarily on changes in reading, mobility, and driving (Leff et al., 2000; Pambakian et al., 2000; Papageorgiou et al., 2007). As a result, little is known about how the presence of VFD, particularly hemianopsia, affects a person’s ability to complete daily occupations and whether it limits performance range. The purpose of this pilot study was to obtain a general understanding of the limitations in occupational performance experienced by adults with VFD (hemianopsia and quadrantanopsia) from ABI. The information provided by the study could contribute to construction of an assessment to measure the level of difficulty in performing ADLs experienced by people with VFD, the cause of these limitations, and ultimately the most effective interventions to promote independence in daily occupations.

**Method**

**Sample**

The study used a convenience sample of adults consecutively referred to an outpatient low-vision rehabilitation program during a 1-year period. The hospital’s Institutional Review Board approved the study. Inclusion criteria included (1) ≥18 years old, (2) hemianopsia or quadrantanopsia resulting from a documented ABI, (3) no significant ocular pathology affecting acuity or field, (4) corrected visual acuity 20/80 or better, (5) sufficient cognitive and language capability to participate in the assessments, (6) no evidence of hemi-inattention or spatial neglect, and (7) no significant physical impairment that may substantially affect ADL performance. Fifty-seven people were screened, and 46 met the inclusion criteria.

**Procedure**

Each participant received the following assessments: a distance visual acuity test, an automated perimetry test to measure visual field, a screening test for hemi-inattention, a reading performance test, and an ADL interview. The visual acuity and perimetry tests were included as part of the examination by the program’s medical director, a low-vision ophthalmologist. An ophthalmic technician completed the acuity and field assessments. The physician’s evaluation took approximately 60 min and was followed by the occupational therapy assessment, which took approximately 90 min. Both assessments were conducted in the program clinic. Two occupational therapists evaluated all study participants. The occupational therapy assessments were conducted in the following order: hemi-inattention screening, reading performance assessment, and ADL interview.

**Instruments**

The Early Treatment Diabetic Retinopathy Study 2000 series charts (VectorVision, Greenville, OH) were used to measure corrected distance acuity in each eye. The visual field was measured with a Humphrey Field Analyzer (Carl Zeiss Meditec, Dublin, CA) using a full-field 120-point screening strategy. The medical director interpreted the test results and documented the visual acuity using a Snellen equivalent and the VFD in terms of location (superior or inferior, left or right visual field), completeness (no areas of central field sparing), and congruity (whether the deficit was homonymous).

Because brain injuries can cause hemi-inattention in addition to VFD and contribute to occupational limitations, each participant was screened for hemi-inattention. The four conventional subtests from the Behavioral Inattention Test made up the screening: Line Crossing, Letter Cancellation, Star Cancellation, and Line Bisection (Wilson, Cockburn, & Halligan, 1987). These subtests were chosen because of their demonstrated sensitivity to detecting the presence of hemi-inattention (Halligan, Wilson, & Cockburn, 1990). Participants scoring below the cutoff score established by the instrument on at least three subtests were considered to have hemi-inattention and were excluded from the study; 7 of the 57 people screened for the study met this criterion.

Reading performance was measured using the Visual Skills for Reading Test (VSRT) developed by Watson, Baldasare, and Whittaker (1990). The VSRT evaluates reading accuracy and rate in people with central field involvement. The test was designed for people experiencing macular scotoma from age-related macular degeneration, and validity and reliability measures were established on that population. Because central visual field impairment in
hemianopsia creates a reading deficit comparable to macular scotoma, the test was considered appropriate to measure reading performance in this population. The VSRT consists of a series of unrelated words arranged into lines of text and printed on sturdy cards. Because the words do not appear in sentences, the reader is forced to rely solely on visual decoding of the word. Many words used in the test can be easily misidentified if not seen entirely. For example, the word *ringer* can be misread as *ring*. Other words can be misread as a single word if the space between them is not seen. For example, *blue* and *berry* may be read as *blueberry*. Each card is constructed so that line and word spacing decrease and word length increases as the reader progresses from the top to the bottom of the test card. The test is administered by having the participant read the words out loud while the examiner records errors and time.

Because the intent of this investigation was not to rate the participant’s performance level but rather to solicit the participant’s perception of which ADLs were the most difficult to perform because of the field loss, I used a semistructured interview format to gather ADL information. The interview addressed five basic ADL (BADL) areas and five instrumental ADL (IADL) areas using categories from the *Occupational Therapy Practice Framework* (American Occupational Therapy Association, 2008; see Figure 1). I described each ADL using the definitions provided in the *Framework*. Participants were asked to answer yes or no regarding whether the ADL was difficult to complete because of the VFD. If the participant answered yes, I asked the participant to describe the difficulties experienced in completing the occupation because of the visual impairment. Family members attending the interview were also permitted to provide information on the participant’s performance. If the participant and family member disagreed, the item was discussed until consensus was obtained.

In addition, I asked the participant about difficulty recognizing faces, reading numbers and words, writing legibly, viewing television, and maintaining orientation during ambulation; anxiousness when navigating and participating in community environments; and collisions with objects on the hemianopic side. These questions were included because my practice experience suggests that they represent areas of specific difficulty for people with VFD. The interview was not taped; I recorded pertinent comments on the recording sheet and then reviewed the comments with the participant to verify accuracy. One investigator reviewed all of the data and entered them into the database, consulting with the second investigator to resolve discrepancies and verify the accuracy of the data.

**Results**

SPSS Version 13 (SPSS, Inc., Chicago) was used to complete data analysis, which included only descriptive statistics. The final sample included 22 men and 24 women between the ages of 27 and 86; the mean age was 65 (Table 1). Stroke was the documented cause of the VFD for all participants except 1 who had sustained a brain tumor and
Table 1. Sample Characteristics (n [%])

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Gender</th>
<th>VFD Type</th>
<th>VFD Side</th>
<th>Field Involvement</th>
<th>Acuity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>22 (47.8)</td>
<td>38 (82.6)</td>
<td>8 (17.4)</td>
<td>36 (78.3)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>24 (52.2)</td>
<td>29 (63.0)</td>
<td>17 (37.0)</td>
<td>10 (21.7)</td>
<td></td>
</tr>
<tr>
<td>Hemianopsia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quadrantanopsia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left half</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right half</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macular Sparring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snellen 20/20–20/40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snellen 20/50–20/80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. N = 46. VFD = visual field deficit.

I had a TBI. Most of the participants had a complete homonymous hemianopsia characterized by central, foveal, and peripheral field involvement in both eyes; the rest of the participants had a homonymous quadrantanopsia. More participants had sustained a left-sided than a right-sided VFD. The length of time elapsed since VFD onset ranged from 2 to 300 weeks with a median of 13 weeks. Participants were asked to describe any significant physical or language limitations experienced as a result of the brain injury or a secondary condition that might affect their ability to complete daily ADLs. Six participants reported mild residual motor impairment from the brain injury; 1 reported mild tremor from Parkinson’s disease. Seven participants reported mild to moderate language deficits from the brain injury. Distance acuity ranged from 20/20 to 20/80; most of the sample had acuities between 20/20 and 20/40. For most participants, the VFD was the most significant impairment caused by the brain injury.

Descriptive analysis of the sample revealed a generally independent, high-functioning group of people before vision loss (Table 2). All participants reported that they had lived in their own home, and all but 1 continued to do so after vision loss. Most lived with a spouse or family member. The participants were asked to describe themselves as limited, moderately active, or very active before the VFD on the basis of descriptions I provided. Of the participants, 98% described themselves as either very or moderately active before the vision loss. All but 6 participants had been driving, and 12 had been working before the vision loss.

Limitations in BADLs

The ADLs that participants identified as being difficult to complete because of the VFD and the percentage of participants reporting limitations in each ADL are presented in Figure 1. Participants identified only two BADLs as problematic: personal hygiene–grooming (41%) and feeding (13%). Grooming challenges included difficulty in applying makeup, cutting nails, and cleaning personal devices (e.g., a shaver). Participants identified two challenges with feeding: not always being aware of food items located on the side of the hemianopsia when food was served to the person, especially if it was the same color as the plate, and knocking over unseen items at the place setting, such as a glass of water.

Limitations in IADLs

All of the participants reported difficulty completing at least one IADL (Figure 1). The most challenging IADLs in order of prevalence were driving (98%), shopping (94%), financial

Table 2. Physical Limitations, Current Living Arrangements, Premorbid Activity Level, and Work Status of Sample (n [%])

<table>
<thead>
<tr>
<th>Status</th>
<th>Physical Limitation</th>
<th>Premorbid Activity Level</th>
<th>Living Arrangement</th>
<th>Work Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>No limitation</td>
<td>39 (84.8)</td>
<td>31 (67.4)</td>
<td>45 (97.8)</td>
<td>34 (73.9)</td>
</tr>
<tr>
<td>Limited</td>
<td>7 (15.2)</td>
<td>14 (30.4)</td>
<td>1 (2.2)</td>
<td>12 (26.1)</td>
</tr>
<tr>
<td>Very active</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited active</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home</td>
<td>45 (97.8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assisted living</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. N = 46. Percentages are based on the complete sample size.
management (89%), and meal preparation (50%). Only 1 participant who drove before VFD onset reported driving again, and she admitted doing so against the advice of her physician. Participants cited multiple mobility challenges in shopping, including getting to the store; maintaining orientation within the store; avoiding collisions with people, displays, and other objects; and locating needed items in aisles. They also reported difficulty in accurately reading labels, identifying food items, and paying for items by check or credit card. Check writing was challenging because of difficulty in positioning the pen accurately and staying on line, which reduced legibility; credit card transactions were difficult when the person was required to use a card reader. Complaints about card readers included difficulty scanning the keypad to locate the required buttons and a lack of standardization between card readers so that the visual-sequencing requirements for transactions were different in every store. In completing financial management, participants reported difficulty accurately reading numbers on bills and staying on line and accurately positioning handwriting on checks and check ledgers, causing reduced legibility.

The most challenging components of meal preparation included reading recipes accurately, measuring food items, locating items on shelves and in the refrigerator, and safely cutting and chopping items. None of the participants reported difficulty with home management, mostly because family members or hired help completed the tasks that were difficult to see. The final challenging IADL was communication device use; 15% of participants reported difficulty accurately dialing telephone numbers. Although participants were not queried regarding leisure participation, they were asked about television viewing. Thirty percent of participants reported difficulty following the action in programs such as sporting events or action shows in which figures moved quickly across the screen.

**Limitations in Performance Skills**

Participants were specifically queried regarding difficulties with the performance skills of reading, writing, and mobility (Figure 2) because they are key components of many IADLs. Shopping, for example, requires all three performance skills; driving requires reading and mobility; and both financial management and meal preparation rely on reading and writing, with the latter also involving limited mobility (transporting meal preparation items). Study participants reported challenges with several aspects of mobility. Nearly 90% of the participants reported experiencing collisions with objects on the side of the VFD during ambulation. Fifty-nine percent of the participants also reported becoming disoriented at times when riding in a car, stating that either it took several minutes without assistance to reestablish orientation after arrival at the destination or that they required assistance from someone to reorient. Almost half (48%) of the participants reported experiencing symptoms of anxiety when moving about in crowded community environments, including shortness of breath, rapid heartbeat, excessive perspiration.

![Figure 2. Percentage of participants reporting limitations in reading, writing, and mobility.](image)

*Note. N = 46; Visual Skills for Reading Test (VSRT), N = 43.*

Downloaded From: http://ajot.aota.org/pdfaccess.ashx?url=/data/journals/ajot/930156/ on 06/22/2017 Terms of Use: http://AOTA.org/terms
dry mouth, a sense of foreboding, and nausea. One participant described his anxiety as “crowd-itis” and reported that he became physically ill if required to go into a crowded store or community event. As a result, he had relinquished all shopping responsibilities to his wife and denied his small children a vacation trip to Disneyland. Almost a quarter (24%) of the participants reported difficulty accurately identifying faces, which decreased their comfort in social participation.

Participants also reported significant challenges in reading and writing. Of the sample, 79% experienced difficulties reading words, and 59% reported difficulty accurately reading numbers. Reading word performance, measured with the VSRT, showed deficiencies in both accuracy and corrected reading rate, with significant variability within the sample. Reading accuracy ranged from 52% to 100%, with a median accuracy of 92%. Corrected reading rate ranged from 6 to 125 words per minute (wpm), with a median of 46 wpm. According to Watson, Whittaker, and Steciw (1995), the client’s overall reading rate can be estimated by multiplying the corrected reading rate on the VSRT by a factor of 1.6. With this adjustment, the maximum reading rate of participants in the sample was 200 wpm, with a median of 74 wpm. This rate is compared with a normal reading rate of 250–300 wpm (Legge, 2007).

Three types of errors caused reduced accuracy on the VSRT: (1) misidentifications (reading the word incorrectly), (2) omitting a word (not reading the word), or (3) skipping a line of text. Misidentification of at least one word on the test was the most commonly committed error, followed by omission of at least one word or letter and skipping at least one line (Figure 2). Although fewer participants reported difficulty with accurately reading numbers, for those who did, the resulting disability may be more significant. Whereas the context of the sentence immediately cues the person that a word was misread so that the mistake can be corrected, misreading numbers does not usually result in such quick feedback. For example, a person who misreads a telephone number may dial that number repeatedly, and if the phone is not answered, the mistake goes unrecognized. Participants who reported difficulty reading numbers stated that they often misidentified numbers with similar visual constructions; thus, an 8 was mistaken for a 3 or a 6 was mistaken for a 5. Some participants reported that fear of misreading a number on a financial statement caused them to relinquish bill paying to a family member or friend.

Nearly 40% of the sample reported difficulty writing legibly. Challenges included the inability to stay on line, a tendency to drift above or below the line when completing forms such as checks, and writing straight on paper without lines such as addressing an envelope and positioning handwriting on a form so that the letters were not crowded.

Discussion

Hemianopsia after brain injury is often considered a mild deficit compared with paralysis or aphasia. The results of this pilot study confirm that people with hemianopsia or quadrantanopsia as the primary deficit from brain injury can resume a mostly independent life, as evidenced by the ability to live at home and complete basic ADLs. However, the study also revealed that people with VFD frequently experience limitations in specific IADLs and that deficiencies appear to result from the detrimental effect of vision loss on visual search and the performance skills of mobility, reading, and writing. Three of the four IADLs most frequently cited as challenging—driving, shopping, and meal preparation—require a wide visual search of surrounding space to complete. All of the IADLs most often cited as difficult required at least one of the performance skills of reading, writing, or mobility. In addition, VFD in combination with the visual demands of the physical environment seemed to elicit emotional and perceptual responses that negatively affect community participation, as evidenced by the high percentage of participants who reported disorientation or feelings of anxiety in community environments.

Implications for Occupational Therapy Practice

Influence of VFD on ADLs

According to the EHP framework, people use environmental cues and features to support task performance. When the participants’ ADL limitations are analyzed from the perspective of the EHP framework, it appears that people with VFD may have difficulty effectively using the environmental context to assist performance. Study participants reported difficulty seeing the small and low-contrast features of objects, which impaired ability to complete tasks such as cleaning a razor, measuring and cutting foods, and accurately dialing a telephone. Participants also reported challenges in successfully managing the space demands of the physical environment of the ADL, as evidenced by more difficulty completing IADLs that required wide visual search and less difficulty completing BADLs, for which search was confined to the space immediately surrounding the body.

Influence of VFD on Key Performance Skills

Disruption of the performance skills of reading, writing, and mobility can also be traced to altered search and difficulty detecting environmental cues or features. Reading deficiencies in hemianopsia are caused by reduction of the perceptual span, which is the fixation “window” used in reading (Zihl,
1995). Hemianopsia reduces the width of the span on the blind side, causing the person to miss the beginning or ending letters of words (misidentification) or miss the word altogether (omission). Hemianopsia can also disrupt visual search during reading, causing the person to skip lines (Zihl, 2000). The person experiences difficulty writing because of the inability to clearly see the pen tip on the line on the hemianopic side. The mobility challenges described by the participants—collisions, disorientation, and anxiety—result from difficulty in searching the environment sufficiently on the blind side to build an accurate and stable environmental context (Pambakian et al., 2000).

**Evaluation Considerations**

According to the EHP framework, people use context to support task performance, and the client’s perception of the context determines how he or she will approach and complete a task. The findings of this investigation suggest that clients with hemianopsia have difficulty detecting the critical environmental features and cues needed for task completion; therefore, it is important that assessment focus on this capability. The therapist should determine whether the client is able to locate and see all of the features of the tools, materials, and equipment used to complete the required task. The therapist should also evaluate the space demands of the ADL. The size of the physical space and the location and visibility of objects and obstacles will determine how much visual search is needed to complete the task. It is also important to analyze the uniqueness of the environment. Built environments often have similar architectural features, creating a uniformity that can make it difficult to distinguish between them. Anyone who has ever walked the halls of a residential facility for older people or passed intersection after intersection with a McDonalds on one corner and a gas station on the other can attest to this fact. The combination of reduced visual input on the hemianopic side and homogenized environmental features may contribute to the high level of disorientation reported by participants.

The client’s psychological reaction to the context must also be assessed. Disorientation, increased incidence of collisions, and anxiety may cause people with VFD to avoid community environments and retreat to the stable and predictable environment of the home. The resulting social isolation may not only prevent the person from resuming a greater level of community reintegration but also hinder psychological adjustment to disability.

**Intervention Considerations**

Two of the five therapeutic interventions described by the EHP framework are particularly applicable to people with VFD: (1) alter the context of the activity or (2) establish or restore the person’s performance skills. To alter the context of the activity, the task components that the client has difficulty identifying should be modified to enhance visibility. For example, mashed potatoes could be served on a black plate and roast beef on a white plate. Visual steps in a task could be eliminated to reduce visual search, such as using the speed dial feature of a telephone or purchasing partially prepared foods. The built environment could be modified to reduce visual search demands by adding structure, reducing the number of objects and obstacles, and increasing their visibility. Restoration of performance skills could be addressed by using therapeutic activities to improve the speed, organization, and width of visual search toward the blind field to prepare the client to engage dynamic environments. Research on restorative interventions is limited, but evidence that people with VFD can be taught to search more efficiently and effectively using visual scanning interventions exists (Nelles et al., 2001; Pambakian, Mannan, Hodgson, & Kennard, 2004; Zihl, 2000). The importance of incorporating restorative interventions to improve visual search into the intervention plan is illustrated by 3 study participants who were between 4 and 5 years postonset of the hemianopsia. Despite the lengthy recovery time, all three showed deficits in reading performance, reported difficulty completing home management tasks, and continued to occasionally experience collisions during ambulation. At least part of their persistent ADL limitations may be because of limited understanding of how to compensate for the hemianopsia. Although all 3 were able to describe the location of the hemianopsia, none of them were able to describe the strategies they used to compensate for the deficit in daily activities. It appeared that without explicit training, these participants had been unable to devise successful compensatory strategies.

**Study Limitations and Future Research**

This study has several limitations. A convenience sample of people referred for low-vision rehabilitation services was used, so the sample may have been biased toward people experiencing more significant ADL limitations. In addition, the interview tool used to assess ADL performance was not subjected to rigorous standards for instrument development. The results of this pilot study should be considered a first step toward identifying the rehabilitation needs of people with VFD. Further empirical investigation using instruments with well-established validity and reliability is required to identify the precise limitations of this population. This study’s results suggest that those investigations should focus on how hemianopsia and other VFDs influence IADLs, especially those completed in community environments.
The high percentage of reported experiences of disorientation has not previously been documented in this population, nor has the high rate of feelings of anxiety in community environments, both of which may have a negative impact on engagement in community IADLs such as shopping, participation in social activities, and driving. Research is needed to determine the best interventions to address both the emotional and visual context of community participation to enable people with hemianopsia and VFD to fully engage in the community. In addition, although most VFD caused by acquired brain injury appear to be hemianopsias, other types of VFD can occur, including quadrantanopsia, central field loss, and peripheral field loss (tunnel vision; Kerkhoff, 2000). Research is needed to determine how various types of VFD influence completion of ADLs. ▲

Acknowledgments

I thank T. Ann Williams, OTR, for her assistance in gathering the data for the study.

References


